Space Weather Technical Forecast

Issued on Wednesday 4 December 2024 at 00:16 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

---

Space Weather Forecast Headline: Chance of isolated M-class flares.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Low with occasional C-class flares, peaking C6.1 at 03/0544 UTC from AR3906 near the southwest limb. There are nine sunspot regions currently on the disc, however the majority are small and simple. AR3906 and AR3905 remained relatively inactive, beside the odd C-class flare, and showed some sign of declining. Two new regions moved onto the disc from over the southeast limb. While potentially also providing a flaring risk, these remain difficult to assess.

No Earth-directed CMEs have been observed, however there are a number of filaments on the Earth-facing disc, including a large north-south filament on the east disc. These will be monitored for any potential lift off.

Solar Wind / Geomagnetic Activity: The ongoing passage of a weak, glancing CME was observed, arriving just before this period around 02/2000 UTC, likely from a filament eruption on 27 Nov. Solar wind speeds were mainly slightly elevated, around 450km/s, while the density fluctuated between average and above average levels until after 03/1700 UTC when it became below average. Interplanetary Magnetic Field (IMF) strength, Bt, was predominately Moderate at 9-15nT, but with Weak spells. The north-south component was mainly Weakly negative (southward), but briefly reaching a minimum of -9nT. However, this included a brief positive (northward) spell at first, peaking 11nT, and became mostly positive after 03/1715 UTC as the CME receded. Phi angle was positive (away from the Sun) for most of the period, but with brief switches to negative (toward the Sun) before becoming more persistently negative after 03/1700 UTC. Geomagnetic activity was Quiet to Unsettled (Kp 2-3).

Energetic Particles / Solar Radiation: High energy proton flux observed by GOES18 was at Background. High energy electron flux (greater than 2MeV) observed by GOES16 was Background. The associated 24-hour fluence was below Active. The 04/0000 UTC observation was 1.57e6 total pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Mostly Low activity is expected with a chance of isolated M-class flares.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs. There are no coronal holes fast wind connections expected through the period, with slightly elevated winds easing to be

---

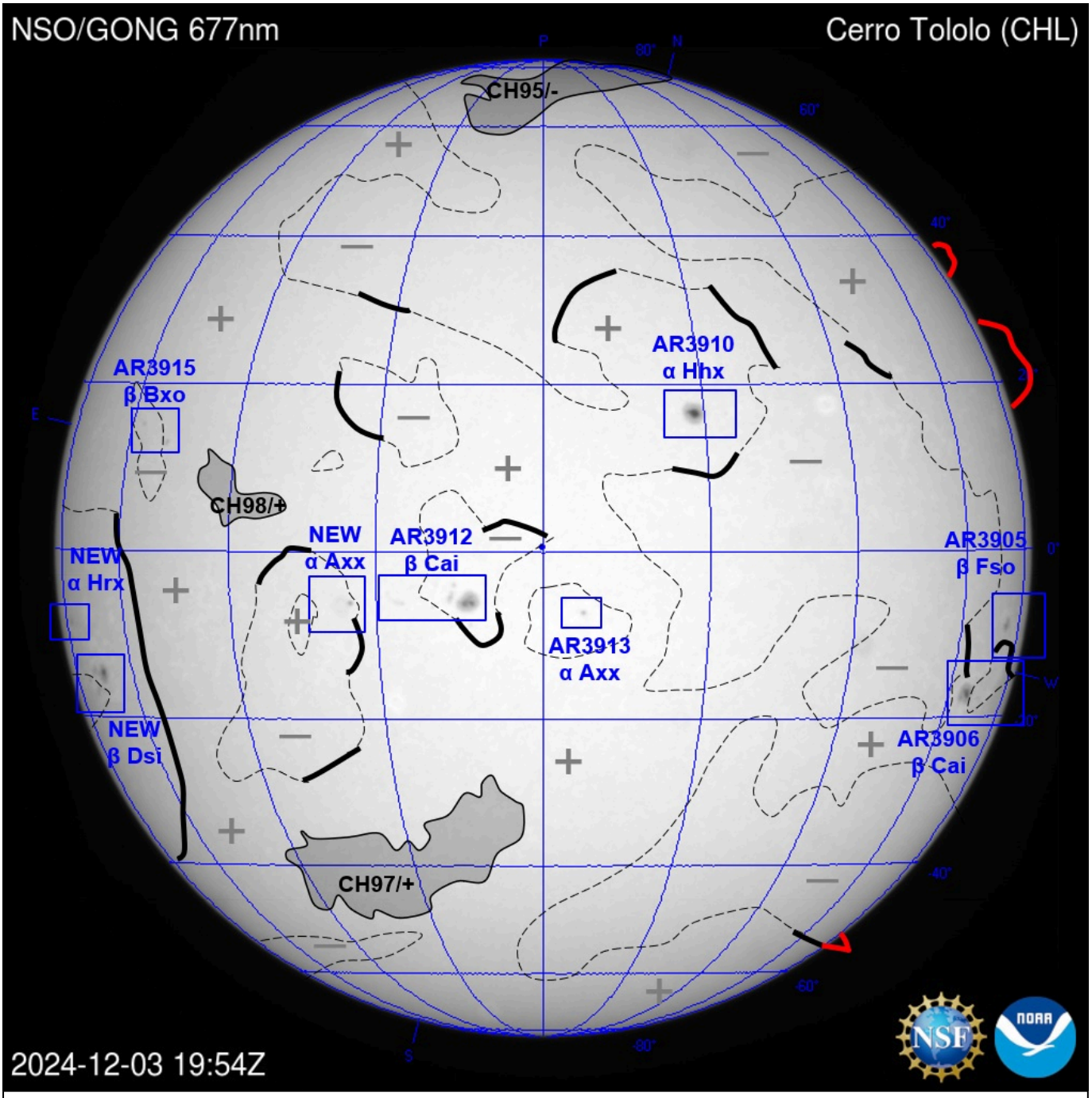
Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

mainly background. Geomagnetic activity is forecast to be Quiet with isolated Unsettled intervals.

Energetic Particles / Solar Radiation: High energy protons are expected to persist at background. High energy electron flux is expected to persist mainly at background with the associated 24 hour fluence remaining below the Active threshold.

Figure 1: Solar Synoptic Map 03/2000 UTC



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Geomagnetic Storms

There are no Earth-directed CMEs. However there are a number of filaments on the Earth-facing disc, including a very large north-south orientated filament in the east which will be monitored as it moves more into the Earth-Sun line later in the period.

Slightly elevated solar winds at first (around 450km/s), are expected to ease a little to become background (below 400km/s). There are no fast wind connections anticipated in the period with CH98/+ currently too far east for this period, and CH97/+ too far south. This is despite MOSWOC Enlil connecting Earth to the northern edge of the HSS from CH97/+ from 05 Dec. This a persistent feature that was further north on the previous rotation and yet had no perceptible influence on the observed solar winds, and is subsequently not expected to be observed on this occasion.

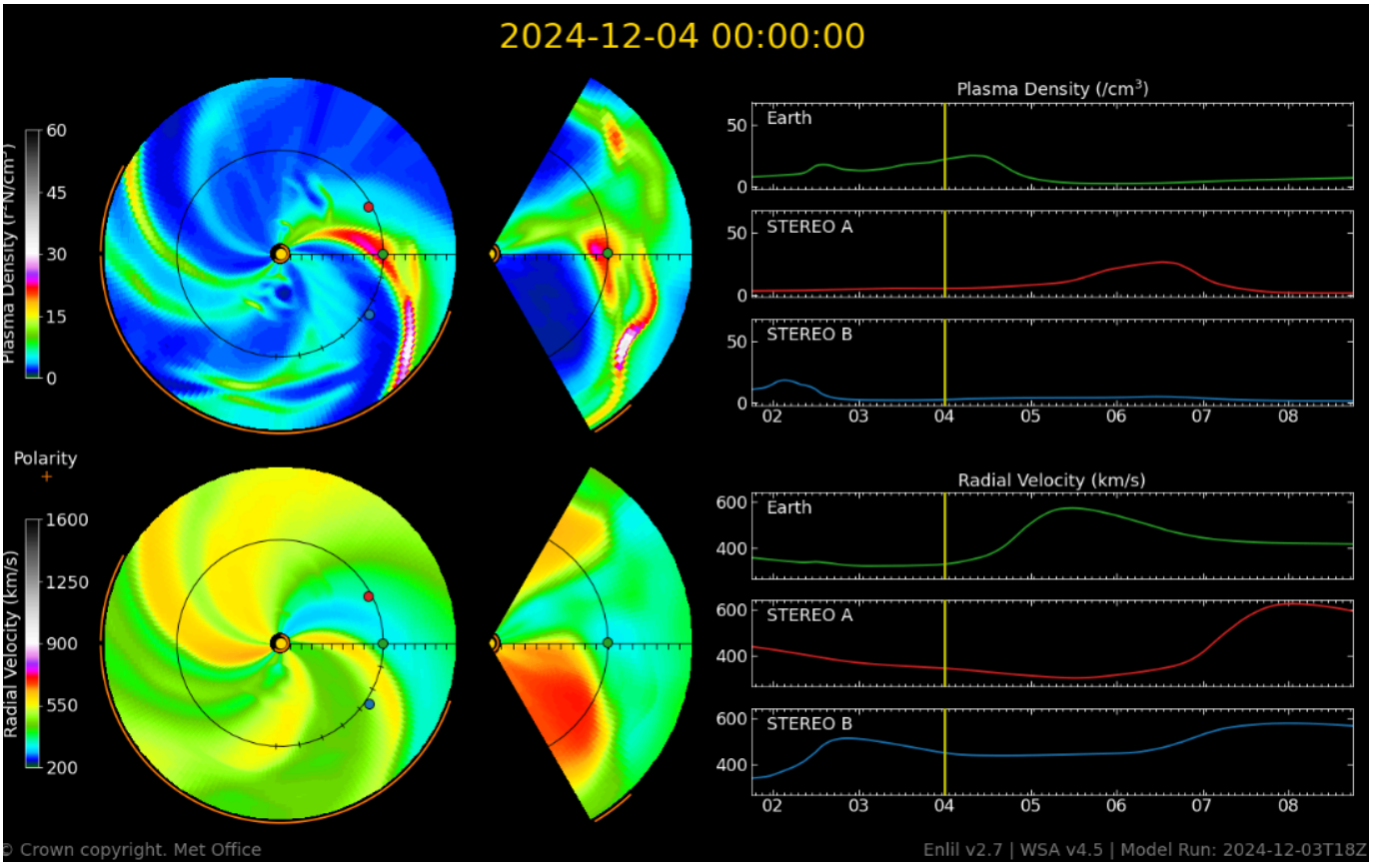
Geomagnetic activity is forecast to be Quiet with isolated Unsettled intervals.

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Figure 2: MOSWOC ENLIL. Strong enhancement to the south is likely too early and extends too far north, with ENLIL providing poor guidance beyond 05 Dec.



© Crown Copyright 2024. All Rights Reserved.

Radio Blackouts - X-Ray Flares

Low activity is expected to continue with occasional C-class flares and a chance of isolated M-class flares.

There are nine sunspot regions currently on the Earth-facing disc, however the majority of these are small and magnetically simple. The main exceptions are AR3905 and AR3906, which are now approaching the southwest limb, and a pair of new regions that have just rotated over the southeast limb. The southwest regions are becoming harder to assess, and have been largely inactive despite their moderate size, but with bright magnetic looping evident in GOES SUVI imagery (e.g. 304 and 195), these still bring the potential of isolated M-flares. The other area of bright magnetic looping is on the southeast limb, associated with the two new regions. These are very difficult to assess in available imagery, but also suggest the potential for isolated M-flares.

Note, assessment of sunspot regions is currently more challenging than usual due to the prolonged outage of available SDO HMI/AIA data with a corresponding lower confidence in flare risk.

X-Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 (M Class)	No	50	50	50	50
Very Active	R3-R5 (X Class)	No	5	5	5	5

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Figure 3: GOES-16/18 X-ray Irradiance

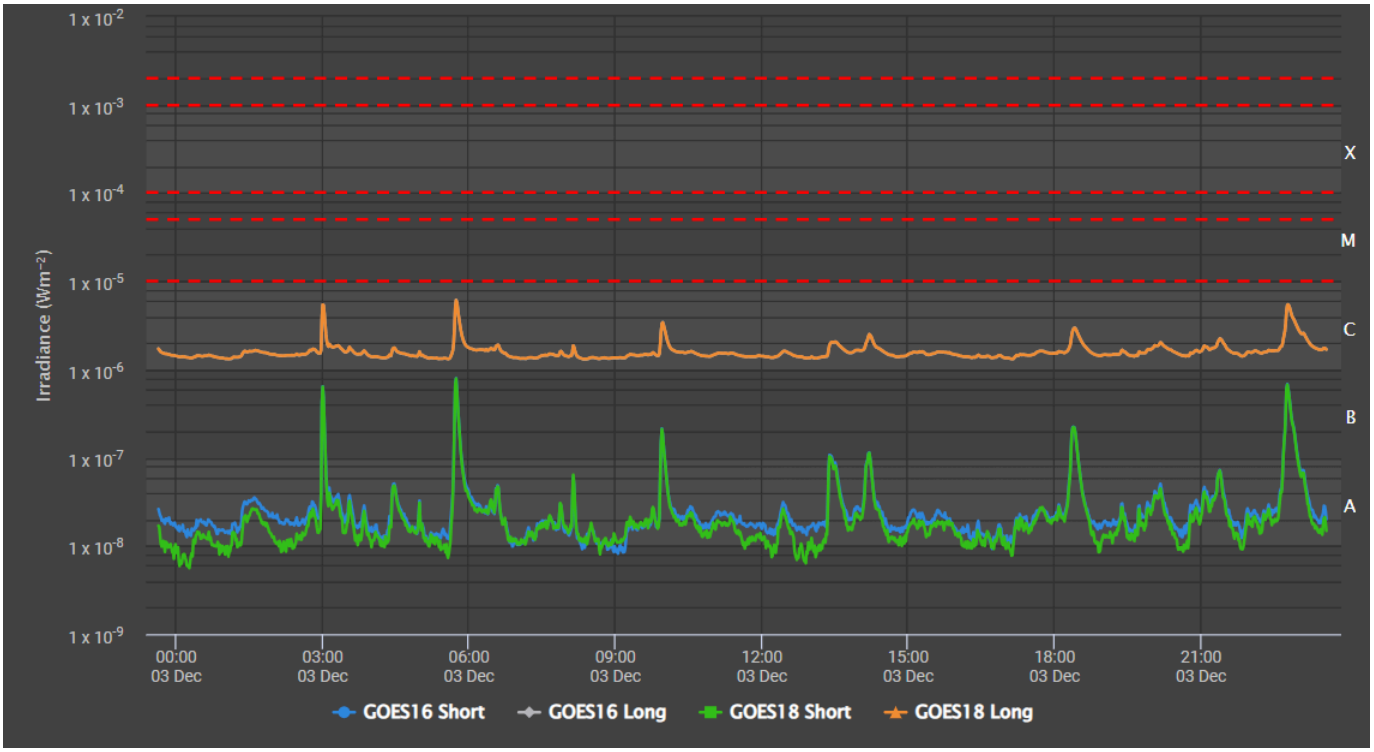
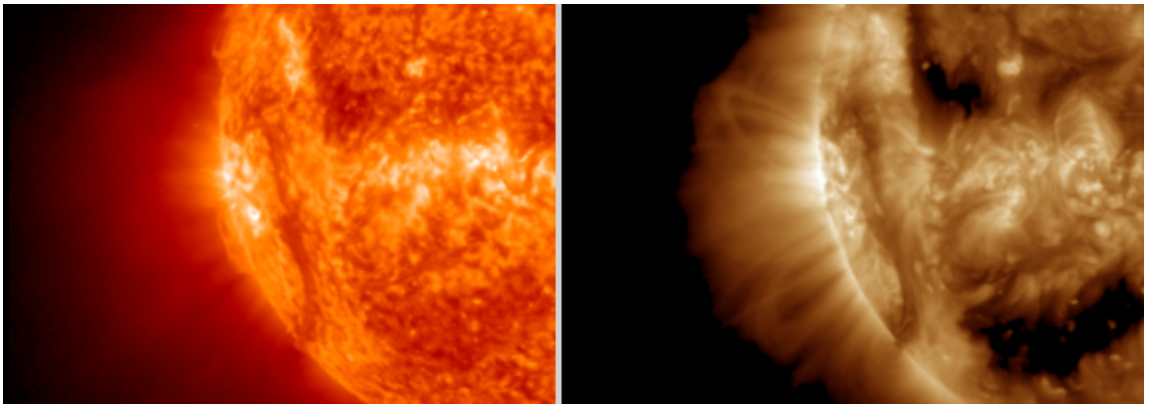


Figure 4: GOES SUVI 304 and 195 showing the potential complexity coming around the SE limb.



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Solar Radiation Storms (High Energy Protons)

GOES-18 Proton flux is currently at background. While there are a couple of moderately sized regions on the better connected western disc, these are relatively simple and inactive. Along with the other regions on the disc also being relatively small and simple, this only gives a very slight chance of high energy proton enhancement through this period.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

High Energy Electrons (≥ 2MeV)

High energy Electron flux observed by GOES-16 is at Background. This is expected to persist, with no significant coronal hole or CME enhancements currently anticipated during the forecast period.

The associated 24 hr fluence is expected to persist below Active levels, with MOSWOC REFM currently considered to be providing good guidance.

GEO Electron Environment	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ 1×10^{8}	No	1	1	1	1
Very Active	≥ 2 MeV ≥ 1×10^{9}	No	1	1	1	1

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.